Formulation of B-DASH Project Guidelines (hydrogen creation, operation management using ICT, energy saving water treatment)

(Study period: FY2014 to FY2015)

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1. Introduction

As sewage sludge was introduced in the MLIT's Productivity Revolution Project as "Japan's original resource that can be used variously, such as biogas, and contribute to productivity enhancement when used thoroughly," there is increasing expectation for use of sewage resources. On the other hand, there still remain many issues in the sewerage service, including reduction of the power consumption in sewerage from the viewpoint of global warming countermeasures. To address such issues, new technologies are expected to play a great role, including promotion of "i-Gesuido" using ICT technology.

Then, from the viewpoint of dealing with the issues in sewerage service by accelerating research and development and practical use of new technologies, the Water Quality Control Department of NILIM has been implementing the Breakthrough by Dynamic Approach in Sewage High Technology Project (B-DASH Project) since fiscal 2011 in collaboration with the Sewerage and Sewage Purification Department of the MLIT.

Under the B-DASH Project, in response to the research contracted out by NILIM, the joint research organization (contractor) constructs a full-scale plant to verify cost reduction, energy saving effect, etc. resulting from the introduction of innovative technologies, etc. Based on the results of such verification, NILIM formulates guidelines for sewerage service providers to consider introduction of the technologies with the aim to disseminate them.

This paper introduces the guidelines for technology introduction formulated in fiscal 2016 based on the findings of the research on the five innovative technologies, which had been continuously demonstrated since fiscal 2014.

2. Outline of the demonstrated technologies

(1) Hydrogen creation energy technology using sewage biogas raw material

This technology is a combination of the pretreatment technology (remove CO_2 with gas separation film and refine high concentration methane), the hydrogen production technology (hydrogen is produced by the reaction of methane and steam and refined to high purity hydrogen through CO_2 adsorption), and the hydrogen supply technology. As efficient production of hydrogen from sewage biogas enables supply of hydrogen to fuel-cell powered cars, contribution of the sewerage service to a hydrogen society is expected (**Fig. 1**).

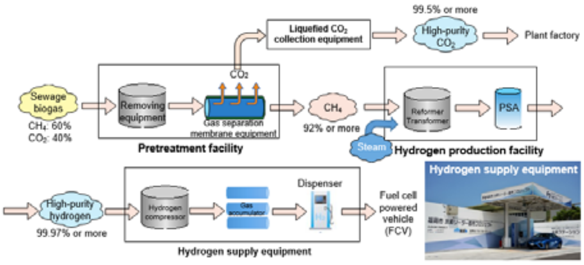

Figure 1: Flow of hydrogen production from sewage biogas

(2) Technology for practical use of ICT-applied efficient nitrification control

This technology is a combination of feedforward (FF) control to forecast air flow required for processing and Feedback (FB) control to determine air flow based on difference between forecast and measured values, by utilizing information measured by two NH_4-N sensors. This technology enables both stable processing and reduced aeration air flow and is expected to contribute to energy saving, etc. in the sewerage service (**Fig. 2**).

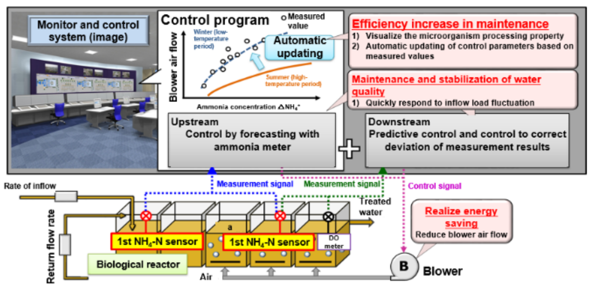

Figure 2: Nitrification operation control technology

(3) Efficient water-treatment operation management technology with process control and remote diagnosis using ICT

This technology consists of three component technologies: (i) Aeration air-flow control technology using NH_4-N sensor, (ii) Control performance improvement technology, and (iii) Multivariate statistical process monitoring technology (, which detects abnormal signs by analyzing correlation of many process data in treatment facilities by statistical approach). This technology enables reduction of aeration air-flow and detection of abnormal signs, so it is expected to contribute to energy saving and efficient maintenance in the sewerage service (**Fig. 3**).

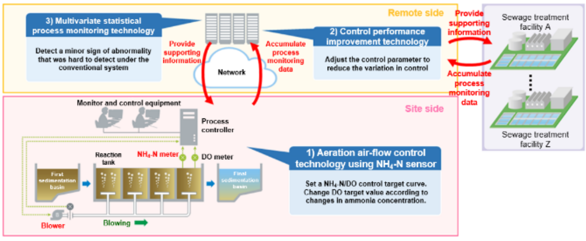

Figure 3: Process control and remote diagnosis technology

(4) Non-aerated circular water treatment technology

This technology is a combination of suspended solid / BOD removal using suspended carrier (pre-stage filtration facilities), BOD removal using microbe-attached carrier in the non-aerated oxygen supply system (sprinkling carrier filter bed), and secure suspended solid removal (final filtration facilities), and does not require aeration power. In addition, this technology enables introduction using the existing frame (conventional activated sludge process) and is therefore expected to contribute to energy saving in the sewerage service (**Fig. 4**).

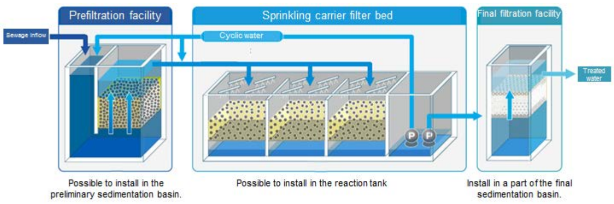

Figure 4: Non-aerated circular water treatment technology

(5) Energy-saving water treatment technology using the high efficiency solid-liquid separation technology and the Dual DO control technology

This technology is used to remove solid matter in influent sewage with high efficiency and space saving using the high efficiency solid-liquid separation technology and form an aerobic zone / anoxia zone with the technology of controlling DO (dissolved oxygen) at two points in the circulating channel prepared by altering the existing channel. This technology enables technical introduction using the existing frame (conventional activated sludge process) and is therefore expected to contribute to energy saving and advanced treatment in the sewerage service (**Fig. 5**).

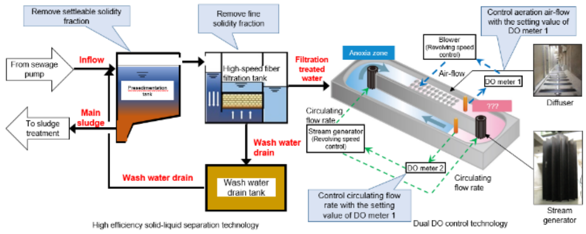

Figure 5: High efficiency solid-liquid separation technology and Dual DO control technology

3. Outline of the guidelines

Based on the findings of the empirical study and opinions of local governments, we formulated guidelines according to each technology and had experts reviewed them. The structure of the guidelines (draft) is as follows (**Table 1**).

Table 1. Structure of Guidelines (draft)

Chapter 1. General Provisions	Objective, scope of application, definitions of terms
Chapter 2. Outline of the Technology	Characteristics of the technologies, conditions of application, evaluation results
Chapter 3. Examination for Introduction	Introduction examination method, examples for examination of introduction effect
Chapter 4. Planning and Design	Introduction plan, design
Chapter 5. Maintenance	Check items, frequency, etc.
Reference Data	Verification results, case study, etc.

4. Utilization of findings and future development

In order to introduce the guidelines to local governments, sewerage-related companies, etc., NILIM held a guideline presentation seminar in Portmesse Nagoya in July 2016, attended by more than 100 persons.

We will continue to introduce the guidelines actively through such presentation seminars, etc. to promote the dissemination of innovative technologies.

Photo: Guideline Presentation Hall

☞**See the following for details.**

[Reference] Various guidelines posted

http://www.nilim.go.jp/lab/ecg/bdash/bdash.htm